

**SECTION 21 05 11**  
**COMMON WORK RESULTS FOR FIRE SUPPRESSION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 21.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 05 50 00, METAL FABRICATIONS.
- D. Section 07 84 00, FIRESTOPPING.
- E. Flashing for Wall and Roof Penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- F. Section 07 92 00, JOINT SEALANTS.
- G. Section 09 91 00, PAINTING.
- H. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- I. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

**1.3 QUALITY ASSURANCE**

- A. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
  - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
  - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

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4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
  6. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- C. Guaranty: In GENERAL CONDITIONS.
- D. Supports for sprinkler piping shall be in conformance with NFPA 13.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
  1. Equipment and materials identification.
  2. Fire-stopping materials.
  3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  4. Wall, floor, and ceiling plates.
- C. Coordination Drawings: Provide detailed layout drawings of all piping systems. Provide details of the following.
  1. Mechanical equipment rooms.
  2. Interstitial space.
  3. Hangers, inserts, supports, and bracing.
  4. Pipe sleeves.
  5. Equipment penetrations of floors, walls, ceilings, or roofs.

D. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A36/A36M-2001.....Carbon Structural Steel
- A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades  
R (2002)
- E84-2003.....Standard Test Method for Burning  
Characteristics of Building Materials
- E119-2000.....Standard Test Method for Fire Tests of Building  
Construction and Materials
- C. National Fire Protection Association (NFPA):
- 90A-96.....Installation of Air Conditioning and  
Ventilating Systems
- 101-97.....Life Safety Code

**PART 2 - PRODUCTS**

**2.1 LIFTING ATTACHMENTS**

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

**2.2 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the

equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
  - 1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
  - 2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
  - 3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

### **2.3 FIRESTOPPING**

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

### **2.4 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:

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1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
  2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

## **2.5 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

## **2.6 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:

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1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
  2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water, chemical, or mechanical injury at completion of all work thoroughly protect all exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- F. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
  2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

### 3.2 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

### **3.3 STARTUP AND TEMPORARY OPERATION**

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

### **3.4 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat

### **3.5 INSTRUCTIONS TO VA PERSONNEL**

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 21 08 00**

**COMMISSIONING OF FIRE SUPPRESSION SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 21.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

**1.2 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.3 SUMMARY**

- A. This Section includes requirements for commissioning the Fire Suppression systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.
- B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

**1.4 DEFINITIONS**

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

**1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in Division 21 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and

of Division 21, is required in cooperation with the VA and the Commissioning Agent.

- B. The Fire Suppression systems commissioning will include the systems listed in Section 01 19 00 General Commissioning Requirements:

#### **1.6 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 CONSTRUCTION INSPECTIONS**

- A. Commissioning of the building fire suppression systems will require inspection of individual elements of the fire suppression construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 19 00 and the Commissioning plan to schedule inspections as required to support the Commissioning Process.

##### **3.2 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist

to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

### **3.3 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 21 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

### 3.5 TRAINING OF VA PERSONNEL

- A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 19 00. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 21 Sections for additional Contractor training requirements.

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**SECTION 21 10 00**  
**WATER-BASED FIRE-SUPPRESSION SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The design and installation of a new hydraulically calculated automatic fire sprinkler system complete and ready for operation, for the entire building including the mechanical equipment rooms, elevator machine rooms, elevator pits, and accessible shafts.
- B. Provide access doors or panels where control or drain valves are located behind plaster or gypsum walls or ceilings as necessary to install piping above suspended plaster or gypsum ceilings.
- C. Painting of exposed piping and supports to follow Section 09 91 00, PAINTING.

**1.2 RELATED WORK**

- A. Treatment of penetrations through rated enclosures: Section 07 84 00, FIRESTOPPING.
- B. Access panels for plaster ceilings: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Painting of exposed pipe: Section 09 91 00, PAINTING.
- D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.
- E. Alarm Supervision: Section 28 31 00, FIRE DETECTION AND ALARM.
- F. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.3 DESIGN CRITERIA**

- A. The design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system shall be in accordance with the required advisory provisions of NFPA 13. Exception to NFPA Fire Codes are as follows:
  - 1. Sprinklers are not required in interstitial areas, except along AGV track systems if the vehicle is combustible.
- B. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.

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1. Sprinkler Protection:
  - a. All office, waiting areas, educational areas, dining areas, corridors and attics: Light hazard, (0.10 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
  - b. Kitchen, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts (if required), Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 9 and 23 m<sup>2</sup> (100 and 250 sq. ft.): Ordinary Hazard, Group 1, 6.1 L/minute/m<sup>2</sup> (0.15 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
  - c. Trash rooms, and storage rooms, storage room over 23 m<sup>2</sup> (250 sq. ft.), areas: Ordinary Group 2, 8.1 L/minute/m<sup>2</sup> (0.20 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
  - d. File Storage Areas with "Rolling Files" Racks: Ordinary Group 2 for the entire area of the space up to 140 m<sup>2</sup> (1500 sq. ft.) area of sprinkler operation.
  - e. Provide sprinklers in accessible shafts per NFPA 13 latest edition.
  - f. Provide sprinklers in gravity type metal chutes per NFPA 82.
2. Add water allowance of 15 L/s (250 gpm) for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
4. Water Supply:
  - a. Elevation of static and elevation of residual test gage: 600 mm (2 ft.) above site grade
  - b. Static pressure: \_45\_\_\_ kPa (psi)
  - c. Residual pressure: \_35\_\_\_ kPa (psi)
  - d. Flow: \_\_1800\_\_\_ L/s (gpm)
  - e. Date: \_n/a\_\_\_ Time: \_n/a\_\_\_ Prescriptive curve from Fresno FD
- C. For each sprinkler zone provide a control valve, flow switch, self-contained test, drain assembly and pressure gage.

- D. Provide a guard for each sprinkler in the janitors' closets, the elevator machine room and sprinklers within 2100 mm (7 ft.) of the floor and other areas as required by NFPA 13.
- E. Seismic Protection: Seismically brace all new and existing piping systems in accordance with NFPA 13 2013 edition. Provide seismic brace calculations.

**1.4 QUALIFICATIONS:**

- A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire Protection Engineering or a NICET (National Institute for Certification in Engineering Technologies) Level III or IV sprinkler technician.
- B. Installer's Qualifications: The installer shall possess a valid State fire protection contractor's license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.
- C. On-site emergency service within one hour notification.

**1.5 SUBMITTALS**

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, HYDRAULIC CALCULATIONS, SEISMIC BRACE CALCULATIONS, PRODUCT DATA, AND SAMPLES.
- B. Sprinkler design shall be done by a certified professional NICET Level III or IV sprinkler technician. All plans shall be stamped by qualified P.E.
- C. Emergency service point of contact name and 24 hour emergency telephone number.
- D. Manufacturer's Literature and Data:
  - 1. Pipe and fittings.
  - 2. Valves
  - 3. Drips
  - 4. Fire Department Siamese Connection
  - 5. Sprinklers-each type, temperature and model
  - 6. Inspectors Test Alarm Modules
  - 7. Sprinkler Cabinets
  - 8. Sprinkler Plugs
  - 9. Pressure Gages

- 10. Pipe Hangers and Supports
- 11. Water Flow Switches
- 12. Valve Tamper Switches
- E. Detailed drawings in accordance with NFPA 13 and NFPA 20 the latest editions. Drawings shall be prepared using CADD software stamped by fire protection professional engineer and include all new and existing sprinklers and piping. Use format in use at the VA medical center. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.
- F. Hydraulic calculations for each sprinkler system in accordance with NFPA 13 latest edition.
- G. Operation and Maintenance Data:
  - 1. Indicating Valves
  - 2. Water Flow and valve tamper switches
  - 3. Pre-action Valves
  - 4. Air Compressor
  - 5. Copy of NFPA 25
- H. Recommended preventive maintenance schedule.

**1.6 AS-BUILT DOCUMENTATION**

- A. Two copies of as-built documents shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on CD , for each drawing.
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the installation which affect the calculations including one electronic set in PDF format.
- D. Four copies of the hydrostatic report and NFPA 13 material and test certificate for each sprinkler system.
- E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions including one copy of NFPA 25.



F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.

#### **1.7 WARRANTY**

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.
- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

#### **1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA)
  - 13-2013.....Installation of Sprinkler Systems
  - 24-2013.....Installation of Private Fire Service Mains and Their Appurtenances
  - 25-2011.....Inspection, Testing and Maintenance of water Based Fire Protection Systems
  - 70-2011.....National Electrical Code
  - 72-2010.....National Fire Alarm Code
  - 82-2009.....Incinerators, Waste and Linen Handling Systems and Equipment
  - 170-2009.....Standards for Fire Safety Symbols
  - 291-2010.....Fire Flow Testing and Marking of Hydrants
- C. Underwriters Laboratories Inc. (UL)
  - 2011.....Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM)
  - 2010.....Approval Guide
- E. American Society for Testing and Materials (ASTM)
  - F442-09.....Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe
- F. American Society of Sanitary Engineering (ASSE)
  - 1015-2009.....Double Check Backflow Prevention Assembly
- G. Complete maintenance and inspection service, sprinkler systems shall be provided by a factory trained authorized representative of the

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manufacturer of the major equipment for a period of one year after acceptance of the entire installation by the government.

- H. Contractor shall provide all necessary test equipment, parts and labor to perform required maintenance.
- I. All inspections, testing and maintenance work required by NFPA 25, NFPA 20, NFPA 13 and recommended by the equipment manufacturer shall be provided. Work shall include operation of sprinkler system alarm and supervisory devices.
- J. Maintenance and testing shall be performed on a quarterly basis. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment, and cleaning of all equipment.
- K. Non-included Work: Maintenance service shall not include the performance of any work due to improper use, accidents or negligence for what the contractor is not responsible.
- L. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of work performed and parts replaced shall be provided.
- M. Emergency Service:
  - 1. Normal and overtime emergency call-back service shall consist of an on-site response to calls within four hours of notification.
  - 2. Overtime emergency call-back service shall be limited to minor adjustments and repairs to affect the integrity of the system.
  - 3. The sprinkler system must be operational before the responding service person leaves the facility.

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## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

## 2.2 PIPING AND FITTINGS

- A. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.
- B. Fire Protection water supply within the building s shall be per NFPA 13 black steel, schedule 10 minimum for all pipe 2 ½" and larger. Schedule 40 for all pipe 2" and smaller,
- C. Threaded or flanged fittings shall be ANSIB1 6.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.
- D. Slip type or clamp-on type rubber gasketed fittings shall be listed for each piping application.
- E. Piping Materials Standards:
  - 1. Ferrous piping - follow ASTM A 795 Standard
  - 2. Welded and seamless steel pipe - follow ANSI/ASTM A 53
  - 3. Wrought steel pipe - follow ANSI/ASME B36.10M
  - 4. Electric resistance welded steel pipe - follow ASTM A 135
  - 5. Seamless copper tube - follow ASTM B 75
  - 6. Seamless copper water tube - follow ASTM B 88
  - 7. Wrought seamless copper and copper alloy tube - follow ASTM B 251
  - 8. Fluxes for soldering applications of copper and copper alloy tube - follow ASTM B 813
  - 9. Brazing filler metal - follow AWS A5.8
  - 10. Solder metal, 95-5 - follow ASTM B 32
  - 11. Alloy material - follow ASTM B 446
  - 12. Non-metallic piping CPVC pipe - follow ASTM F 442
- F. Fitting Materials Standards:
  - 1. Cast iron threaded fitting, Class 125 and 250 - follow ASME B16.4
  - 2. Cast iron pipe flanges and flanged fittings - follow ASME B16.1
  - 3. Malleable iron threaded fittings, Class 150 and 300 steel - follow ASME B16.3
  - 4. Factory made wrought steel buttweld fittings - follow ASME B16.9
  - 5. Butt welding ends for pipe, valves, flanges, and fitting - follow ASME B16.25

6. Wrought copper and copper alloy solder joint pressure fittings - follow ASME B16.22
7. Cast copper alloy solder joint pressure fitting - follow ASME B16.18
- G. Pipe Identification - All pipe, including specially listed pipe allowed by NFPA 13, shall be marked continuously along its length by the manufacturer in such a way as to properly identify the type of pipe. Pipe identification shall include the manufacturer's name, model designation, or schedule.

### 2.3 VALVES

- A. Listed Indicating Valves:
  1. Gate: OS&Y, 2400 kPa (350 psi )Water Working Pressure (WWP).
  2. Butterfly: Gear operated, indicating type, 2400 kPa (350 psi) water working pressure (WWP). Butterfly valves are to be installed in a manner that does not interfere with the operation of any system component.
  3. Ball (inspectors test and drain only): iron body, stainless steel trim, for 2050 kPa (300 psi) service, indicating type.
  4. Ball and butterfly valves shall not be used on incoming water service, and on the suction side of either the fire pump or jockey pump.
- B. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 2400 kPa (350 lb.) water working pressure (WWP).
- C. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 4100 kPa (600 psi), Water or gas (WOG) equipped with reducer and hose connection with cap or connected to a drain line.
- D. Self-contained Test and Drain Valve:
  1. Ductile iron body with bronze "Drain" and "Test" bonnets. Acrylic sight glass for viewing test flow. Various sized orifice inserts to simulate flow through 14 mm (17/32 in.), 13 mm (1/2 in.), 12 mm (7/16 in.), and 10 mm (3/8 in.) diameter sprinklers, 32 mm (1 1/4 in.) female threaded outlets or 32 mm (1 1/4 in.) one-quarter turn locking lug outlets for plain end pipe (end preparation to be in accordance with manufacturer's recommendation).
  2. Bronze body, with chrome plated bronze ball, brass stem, steel handle, Teflon seat and sight glasses. Provide valve with three

position indicator plate (off, test, and drain), 6 mm (1/4 in.) tapping for pressure gage and various other orifice inserts to simulate flow through 13 mm (1/2 in.), diameter sprinklers.

- E. Double Check Backflow Prevention Assembly: Provide two independent check valves with OS&Y shut off valves, ball type test cocks. Maximum friction loss through assembly shall not exceed 35 kPa (5 psi) at design flow. Unit shall be functional in vertical or horizontal position, rated for 1200 kPa (175 psi) working pressure. Check valve assembly shall be in accordance with AWWA Class D. Double check backflow prevention assembly shall be FM approved, ASSE approved and UL listed.

#### **2.4 AUTOMATIC BALL DRIPS**

Cast brass 20 mm (3/4 in.) in line automatic ball drip with both ends threaded with iron pipe threads.

#### **2.5 FIRE DEPARTMENT SIAMESE CONNECTION**

Brass, pad mounted, exterior fire department connection with brass escutcheon plate, without sill cock, and a minimum of two 65 mm (2 1/2 in.) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler". Provide connection with a swing check valve. Install an automatic ball drip between fire department connection and check valve to discharge over an indirect drain connection or to the outside. When additional alarm valve is installed, additional check valve is not required. Check valves must be installed in accordance with their vertical or horizontal listing.

#### **2.6 SPRINKLERS**

- A. Quick response sprinklers shall be standard type except as noted below. The maximum distance from the deflector to finished ceiling shall be 50 mm (2 in.) for pendent sprinklers. Pendent sprinklers in finished areas shall be provided with semi-recessed adjustable screwed escutcheons and installed within the center one-third of their adjustment. The sprinkler shall be installed in the flush position with the element exposed below the ceiling line. At the specified locations, provide the following type of sprinklers. All sprinklers are to be

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Institutional type. All sprinklers except "institutional" type sprinklers shall be FM approved. "Institutional" type sprinklers in Mental Health and Behavior Units shall be UL listed or FM approved quick response type. Maximum break away strength shall be certified by the manufacturer to be no more than 39 kPa (85 pounds). Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval, and the following:

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LOCATION	TYPE
Mechanical Equipment Rooms, Electrical & Electrical Switch Gear Rooms	Quick Response, Upright or Telephone Closets, Transformer Vaults Pendent Brass [93 °C (200 °F)]
Elevator Shafts, Dumbwaiter Shafts, Elevator Machine Rooms, Elevator Pits	Standard Upright or Sidewall Brass [93 °C (200 °F)]
Gravity Type Linen & Trash Chutes	Standard Upright or Pendent Brass [66-74 °C (150-165 °F)]
Warehouse [Storage under 3600 mm (12 ft.)]	Quick Response, Pendent or Upright, Brass [77-74 °C (150- 165 °F)]
Warehouse [Storage over 3600 mm (12 ft.)]	See NFPA 13
Cold rooms, Freezers, Controlled Temperature Rooms and Unheated Areas	Standard Pendent, Dry Type [66- 74 °C (150-165 °F)]
Kitchen Hoods, Exhaust Ducts & Duct Collars	Standard Pendent or Upright (Extra High Temperature [163-191 °C (325- 375 °F.)])
Generator Rooms	Standard Pendent or Upright [141 °C (286 °F)]
Mental Health and Behavioral Unit: Nursing Bedroom, Toilets and all areas	Institutional Quick Response; Chrome plated with 85 lb. breakaway, Pendent, Horizontal Sidewall [66-74 °C (150-165 °F)]
All Patient Treatment, Elevator Lobbies and Corridors	
	Quick Response, Recessed Pendent, Chrome Plated, Sidewall [66-74 °C (150-165 °F)]
All Areas Not Listed Above	Quick Response, Residential Recessed Pendent, Sidewall, Chrome Plated [66-74 °C (150-165 °F)]

B. Do not use quick response sprinklers in the same sprinkler zone with other sprinklers types. In sprinklered light hazard patient zones that

are expanded into fully sprinklered zones, revise the existing system to contain quick response sprinklers.

C. Sprinklers to be installed as per NFPA 13.

## **2.7 TOOLS AND REPLACEMENT PARTS**

A. Sprinkler Cabinet:

1. Provide a minimum 5 percent spare sprinklers with escutcheons with a minimum of two of each type/or as required by NFPA-13, whichever is more demanding.
2. Provide a minimum of two of each type sprinkler wrenches used.
3. Install cabinets in each building where directed by the Resident Engineer.
4. Spare sprinklers shall be kept in a cabinet where ambient temperatures do not exceed 100 Deg F.

B. Sprinkler system water flow switch: one of each size provided.

C. Sprinkler system valve tamper switch: one of each type provided.

D. Sprinkler system pressure switch: one of each type provided.

E. Provide two sprinkler plugs attached to multi-section extension poles 2400 mm (8 ft.) minimum.

## **2.8 AIR COMPRESSOR**

A. Provide air compressor specifically approved for a dry sprinkler system with UL Listed FM Approved dry valves.

B. Compressor shall maintain the required operating pressure on the dry system and be capable of full recovery within 30 minutes of an emergency.

C. Provide a 120 volt electrical connection to a non-switched dedicated electrical connection and equip with an hourly run meter.

D. A check valve or other positive backflow prevention device shall be installed in the air supply to each system to prevent airflow or waterflow from one system to another.

E. Where the air compressor feeding the dry pipe system has less capacity than the discharge through a 1/8 in. orifice at 10 psig, no air maintenance device shall be required.

F. A listed relief valve shall be provided between the compressor and controlling valve and shall be set to relieve at a pressure 10 psi in excess of the operating air pressure of the system.



- G. Automatic air supply to more than one dry pipe system shall be connected to enable individual maintenance of air pressure in each system.

## **2.9 IDENTIFICATION SIGNS**

Provide for all new valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

## **2.10 HANGERS AND EARTHQUAKE BRACING**

In accordance with NFPA 13 and 14. Comply with seismic requirements as per 15050 for seismic zone locations.

## **2.11 WATERFLOW SWITCHES**

- A. Integral, mechanical, non-coded, non-accumulative retard type, with two sets of SPDT auxiliary contacts and adjustable from 0 to 90 seconds. Set flow switches at an initial setting between 20 and 30 seconds B. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

## **2.12 VALVE SUPERVISORY SWITCHES**

- A. Provide each indicating sprinkler, standpipe and fire pump control valve with adequate means for mounting a valve supervisory switch.  
B. Mount switch so as not to interfere with normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem is moved no more than one fifth of the distance from its normal position.  
C. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 20 mm (3/4 in.) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.  
D. Switch housing to be finished in red baked enamel.  
E. Supervisory switches for ball and butterfly valves may be integral with the valve.  
F. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

### **2.13 WALL, FLOOR AND CEILING PLATES**

- A. Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.
- B. Comply with NFPA 101 Fire Barrier Penetration codes.

### **2.14 PRESSURE GAUGE**

- A. Provide a // 690 kPa (100 psi) // 1280 kPa (200 psi) // pressure gauge at each flow alarm switch location, at the top of each sprinkler or standpipe riser, at each main drain connection, and on the suction and discharge of the fire pump.

### **2.15 HANGERS**

- A. Hangers shall be designed to support five times the weight of the water filled pipe plus 250 Lb (114Kg) at each point of piping support.
- B. These points of support shall be adequate to support the system.
- C. The spacing between hangers shall not exceed the value given for the type of pipe as indicated in NFPA 13 tables.
- D. Hanger components shall be ferrous.
- E. Detailed calculations shall be submitted, when required by the reviewing Authority, showing stress developed in hangers, piping, fittings and safety factors allowed.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Supervisory Switches: For each indicating sprinkler system riser, main service entrance, PIV (post indicator valve), control valve, provide a supervisory switch that is connected to the fire alarm system.
- B. Waterflow Switches: For each sprinkler riser where indicated on drawings, provide a waterflow switch. Install waterflow switch and adjacent valves in easily accessible locations.
- C. Piping connections:
  - 1. Sprinkler System Only: Start at flanged outlet within the building at exterior wall.
- D. Drains, Test Pipes and Accessories:
  - 1. Provide a drain at base of risers, drain connection on valved sections, and drains at other locations for complete drainage of the system. Provide valve in drain lines and connect to the central

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- drain riser. Discharge riser outside over splash block, indirectly over standpipe drain connected to storm sewer, or as indicated. The main drain shall be capable of full discharge test without allowing water to flow onto the floor.
2. Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above for drains.
- E. Provide a // 690 kPa (100 psi) // 1280 kPa (200 psi) // pressure gage at each flow alarm switch location, at the top of each sprinkler or standpipe riser, at each main drain connection, and on the suction and discharge of the fire pump.
- F. Conceal all piping, except stairwells and rooms without ceilings.
- G. Install new piping and sprinklers aligned with natural building and other sprinklers lines.
- H. Locate piping in stairways as near ceiling as possible to prevent tampering by unauthorized personnel. Provide a minimum headroom of 2250 mm (7 ft.-6 in.) for all piping.
- I. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.
- J. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.
- K. For each new or existing fire department connection, locate the symbolic sign given in NFPA 170 a distance of 2400 to 3000 mm (8 to 10 ft.) above each connection location. The sign shall be 450 x 450 mm (18 x 18 in.) with symbol at least 350 x 350 mm (14 x 14 in.).
- L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire walls shall be sealed on a daily basis.
- M. Provide hydraulic design information signage as required by NFPA 13 and 14.

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N. Install access doors in ceilings of rooms where above ceiling access is required.

**3.2 TEST**

- A. Automatic Sprinkler System: NFPA 13 and 25.
- B. Standpipe and Hose System: NFPA 25.
- C. Centrifugal Fire Pumps: NFPA 20.

**3.3 INSTRUCTIONS**

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the fire pump and sprinkler system, on the dates requested by the COTR.

- - - END - - -

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**PREACTION SYSTEM SPECIFICATION**

**PART 1 - GENERAL**

**1.1 RELATED WORK IN OTHER SECTIONS**

- A. Fire Protection General Prescription Division 21.
- B. Electrical Division 26.
  - 1. Supply and install one dedicated 110VAC, 60Hz branch circuit to power the release control panel.
  - 2. Supply and install a second branch circuit, 110VAC, 60Hz for the air compressor provided inside the preaction cabinet by the factory.
  - 3. The (two) independent circuit(s) shall be well identified and their circuit breaker locked.

**1.2 APPLICABLE STANDARDS**

- A. NFPA 13 (Installation of Sprinkler Systems).
- B. NFPA 25 (Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems).
- C. NFPA 72 (Standard for the Installation, Maintenance, and Use of Protective Signaling Systems).
- D. NFPA 72E (Standard on Automatic Fire Detectors).
- E. National Building Code.
- F. National Fire Code.
- G. National Electrical Code.
- H. OSHPD approved Option.

**1.3 SYSTEM DESCRIPTION**

- A. Supply and install a self-contained TotalPac2 integrated fire protection system, preaction type as indicated. No substitutions allowed. Including:
  - 1. Preaction cabinet (California State Approved with OSHPD Seismic option).
  - 2. Automatic sprinkler system.
  - 3. Fire detection system.
- B. The integrated unit shall be c-UL-us Listed and FM approved as an assembled unit. All system components shall be "compatible", UL/ULC listed or FM approved.

Note: The word **compatible** used in this specification means that the items concerned have been tested and listed and/or approved for their use together.

#### **1.4 SYSTEM DESIGN**

- A. The system must be designed for:
  - 1. Occupancy hazard: Ordinary Hazard Group 1 per NFPA 13, 2010 edition.
  - 2. Density: .15 gpm/sq.ft.
  - 3. Area of sprinkler operation: Entire Area.
- B. Water Supply:
  - 1. Location: Prescriptive Flow provided by City of Fresno Fire Department.
  - 2. Static pressure: 45 psi.
  - 3. Residual pressure: 35 psi.
  - 4. Water flow: 1800 gal/min.
- C. The maximum area coverage per smoke or heat detector shall meet NFPA-72 requirements and not exceed the manufacturer's recommendations.

#### **1.5 DRAWINGS & HYDRAULIC CALCULATIONS**

- A. The fire protection contractor must prepare and submit for the engineer's approval all installation drawings and hydraulic calculations, as required by NFPA.

#### **1.6 TECHNICAL DATA**

- A. Submit for the engineer's approval a set equipment datasheets which will include all technical data of each essential component of the system such as integrated unit and options, automatic sprinklers, control system, etc.

#### **1.7 MAINTENANCE & OPERATION MANUAL**

- A. Supply a standardized and listed Maintenance & Operation manual for the preaction system.
- B. This manual must include all necessary instructions to operate and maintain the system, and be explicit regarding the interaction between the hydraulic aspect (deluge valve and trim) and the detection portion. Emergency procedures must form an integral part of the manual.
- C. Supply separate user manuals specific to the release control panel and the air compressor (when applicable).

#### **PART 2 - COMPONENTS**

## 2.1 PREACTION CABINET

- A. Supply and install a double interlocked preaction cabinet with electric-pneumatic release and control panel containing all hydraulic, pneumatic and electrical components required for the control of a preaction system. The cabinet shall be manufactured by Fireflex with Viking components with no substitutions allowed and shall include the following:
1. Self-contained unit (with release control panel) in sturdy free-standing 14 gauge steel cabinet, measuring: 71" x 36" x 20" (180 x 91 x 51cm) for 1½", 2" & 3" systems; 71" x 46" x 24" (180 x 117 x 61cm) for 4" & 6" systems.
  2. Textured rust proof coating, inside and outside, fire red, oven baked polyester powder on phosphate base (powder coated).
  3. Two locked access doors to reduce front area required for opening, easily removable without tools to allow easy installation & servicing.
  4. Individual access doors for the hydraulic and electrical sections and the emergency release with a neoprene gasket to avoid vibrations.
  5. Viking Deluge Valve model E, complete with releasing trim rated at 250 psi and all the necessary accessories. Trim shall include a mechanical latching device to prevent system from resetting in case of loss of power to the release solenoid. Systems provided with solenoid only, without this mechanical latching device, shall not be accepted. Every valve shall be clearly identified as to its operation with arrows indicating all positions to facilitate system operation.
  6. Pressure gauges to indicate water supply, priming water and air pressures of the system. Each pressure gauge must be provided with its own shut-off valve and shall be clearly identified on the outside of the cabinet front door.
  7. Schedule 40 galvanized steel release trim with solenoid valve and every supervisory and alarm device required. Black pipe will not be accepted.
  8. Schedule 40 steel pipe header painted fire red, with grooved ends to be connected to supply water from either side.

9. Schedule 40 steel pipe drain manifold of 2" diameter painted fire red, with grooved ends for drain connections from either side.
10. Properly identified contractor test ports factory mounted into the trim piping to facilitate system testing and commissioning.
11. Viking VFR-400 integrated control panel with emergency batteries, in a top mounted enclosure its own access door and a spare sprinklers storage rack.
12. Field wiring terminal strips integrated with the cabinet for connection of field wiring for auxiliary contacts and power supply for the optional air compressor.
13. The cabinet assembly must be pre-assembled, pre-wired and factory tested under ISO-9001 conditions, as a Viking TotalPac2 System, by FireFlex Systems Inc. It shall also be c-UL-us Listed and FM Approved as an assembled unit. System shall be California State Fire Marshal Approved with OSHPD Approved seismic feature.

## **2.2 REQUIRED OPTIONS**

- A. Provide a Listed and Approved isolation butterfly valve installed on the system riser inside the cabinet for full flow test purposes. The valve shall be supervised by the same supervisory circuit as the system main water supply valve tamper and wired at the factory. An integrated sight glass shall be part of this arrangement for visually confirming water flow through the main drain upon system actuation. A detailed instructions placard must be provided inside the cabinet door for easy reference.

## **2.3 INTEGRATED CONTROL PANEL**

- A. The release control panel must be fully integrated to the TotalPac2 cabinet and installed in his own enclosure, mounted at the factory on top of the trim enclosure. Standard wall enclosure normally provided with control panels shall not be used and this arrangement shall be fully Listed & Approved as part of the integrated unit. Panels provided with their regular wall mounted enclosure fitted in the front door of the cabinet will not be considered as fully integrated and shall not be acceptable.
- B. The control panel shall be FM Approved and cULus listed to the new UL 864-9 standard. Panel shall include four programmable Class B, Style B



initiating zones, two class B supervisory zones, and four programmable output circuits. Onboard, menu-driven programming with twelve pre-installed programs for ease of set-up must also be provided. The panel must be compatible with many different initiating devices including linear heat detection, smoke and heat detectors, water flow indicators, low air pressure switches, and manual pull stations.

- C. The control panel should include both an LCD Annunciator describing all system conditions (16 characters on 2 lines) and a set of yellow & red LED lamps identifying each separate alarm and trouble conditions. Easy to operate control buttons shall also be included for the operation of the panel various functions.
- D. The control panel should be pre-wired at the factory to a set of industrial grade wiring terminals used for power feed, separate from the terminals used to power the optional air compressor. External wiring to field devices (outside the cabinet) should be wired directly to the control panel module by the installing contractor.
- E. A set of emergency batteries should be provided with the control panel. Batteries should be calculated to provide emergency power for a specific duration after which they shall be able to provide 5 minutes of alarm and activation of the solenoid valve(s). *Required stand-by duration: 10 minutes of alarm after 90 hours stand-by (FM).*

#### **2.4 AVAILABLE OPTIONS**

A. Applicable Options:

- ☐ Class A, Style D initiating device circuits: When Class A, Style D wiring is mandated by the Authority Having Jurisdiction, the contractor shall provide CA2Z modules and install them on-site.
- ☐ Class A, Style Z indicating appliance circuit: When Class A, Style Z wiring is mandated by the Authority Having Jurisdiction, the contractor shall provide CAM modules and install them on-site.
- ☐ Remote Annunciator: When a remote annunciator is mandated by the Authority Having Jurisdiction or local codes, the contractor shall provide a model RA-4410RC remote annunciator module and install it on-site following the instructions provided by the manufacturer. Remote annunciator shall be mounted on a standard four gang wallbox

provided by the contractor. It should also include the following features:

- a) 33 red & yellow LED lamps to annunciate various alarm & trouble system status;
- b) Trouble and supervisory buzzer with combined silence/lamp test switch;
- c) RS-485 interface with the release control panel allowing up to 4 remote annunciators can be connected to the control panel.

## **2.5 DETECTION & SIGNALING DEVICES**

- A. Supply and install a complete electrical detection system including:
  - 1. System tubing, wiring, heat and/or smoke detectors, signaling devices and connections to auxiliary functions.
- B. Heat and/or smoke detectors can be wired on either zones 1 or 2. Where more than the allowable quantity of detectors are required on a same detection zone, use the recommended 4-wire type detector base for that detector. Spacing and type of detectors shall meet the requirements of the applicable standards and the manufacturer's recommendations for the application protected.
- C. The detection and alarm indicating devices (24 Vdc bell, horn or strobe) must be compatible with the release control panel.
- D. A bell or a horn should be installed near the TotalPac2 cabinet.
- E. Supervisory tamper and pressure switches mounted inside the cabinet by the factory should be wired to two separate zones and provide separate indications for tamper and air supervisory.

Note: Refer to the applicable compatible device list provided in the panel Installation, Operation & Instruction Manual to determine which compatible initiating and signaling devices model number to use.

## **2.6 SIGNALING OPTIONS**

- A. Applicable Options:
  - ☐ The VFR-400 panel provides 4 sets of dry contacts. When additional dry contacts are required, use Viking p/n MR-101 (SPDT), MR-201 (DPDT) and/ or MR-801 (SPDT with LED). These field devices shall be installed OUTSIDE the TotalPac2 enclosure and are provided by the installing contractor.

## **2.7 SYSTEM OPERATION**

- A. System sequence of operation shall be pre-set at the factory and perform the following:
1. The activation of BOTH the detection condition AND the opening of an automatic sprinkler is necessary to cause the water discharge.
  2. Single zone operation (Factory Program #1): The activation of EITHER detection zone 1 or 2 alone will activate the solenoid valve, sound an alarm and activate alarm contacts for auxiliary functions, but will not cause the system to fill with water.
  3. The opening of an automatic sprinkler OR damage to system piping without the detection condition satisfied will activate the pneumatic actuator, sound an supervision signal and activate dry contacts for auxiliary functions but will not cause the system to fill with water.
  4. Activation of BOTH the detection condition AND the opening of an automatic sprinkler will activate both the solenoid valve and pneumatic actuator, open deluge valve and sound an alarm. This will activate alarm and water flow contacts connected to the remote control panel.
  5. Pressure loss (and optional high pressure condition) on the sprinkler system will activate supervisory condition and auxiliary contact indicating the condition.
  6. Operation of the emergency manual release will drain the priming chamber of the deluge valve, causing the system to immediately fill the piping network with water, and activate alarm and water flow contacts connected to the building fire alarm panel.

## **2.8 AIR SUPPLY**

- A. The automatic sprinkler piping is supervised by compressed air from a source installed inside the preaction cabinet.
- B. The air supply must be regulated and of the proper size in order to be able to restore normal system air pressure within 30 minutes.
- C. Air compressor and supervisory trim (Air Supply Style "A") shall be provided inside the cabinet and its pressure factory adjusted for the selected configuration.

## **2.9 AIR SUPPLY OPTIONS**

- A. If required by the size of the piping network, an accelerator device, Viking Model E-1 shall be factory installed in the air trim with its own

pressure gauge and bypass valve, designed to increase the operating speed of the system.

- B. For high humidity environments, a dehydrator assembly must be factory installed in the air trim, with bowl guard, supply control and drain valves. Dehydrator shall be Viking manually generated dessicant-type air dryer, the dessicant acting as a moisture indicator by changing color.

#### **2.10 AUTOMATIC SPRINKLERS**

- A. Supply and install all required pre-action automatic Sprinklers. Sprinklers shall be installed per the latest Edition of NFPA 13 Preaction Section. Note: Same make of sprinklers and same type of sprinklers and arrangements for preaction system applications shall be used in cases where earlier editions of NFPA 13 is being used. Fire sprinklers shall be of one manufacturer throughout the building. No mixing of sprinkler brands shall be permitted. Sprinklers shall be of all brass frame construction with a metal Belleville spring seal, coated on both sides with Teflon film. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited. Sprinklers shall have a quick response frangible bulb type fusible element. Sprinklers to be installed in areas with no ceilings shall be of a brass finish and shall be of adequate temperature for the hazard. Exposed sprinklers subject to corrosive atmospheres shall have a factory applied corrosion resistant coating.

- 1. Upright Microfast Quick Response Sprinkler: Upright Sprinklers shall have a standard or large orifice and a 5.6 or 8.0 nominal K Factor. Sprinklers shall be cULus Listed and/or FM Approved. Quick response sprinklers shall be listed for installation in an Ordinary Hazard occupancy if installed in an Ordinary Hazard occupancy. Quick Response Sprinklers (formerly Model M) shall be Viking SIN VK300 (5.6K Standard Orifice Upright), or SIN VK350 (8.0K Large Orifice Upright). (No Substitutions Allowed).

#### **2.11 PIPING**

- A. All piping shall be schedule 40 with threaded or grooved connections.

#### **2.12 SYSTEM DRAIN**

- A. The single drain collector of the Viking TotalPac2 system shall be connected to an open drain (open end pipe with an air gap around the

drain pipe or equivalent). The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector. It shall also be arranged to avoid back-pressurizing the drain trim. Multiple drain collectors and open drain cups inside the cabinet will not be accepted.

- B. Manifolding of multiple units is permitted provided the manufacturer's recommendations are carefully followed and complied with.

### **2.13 INSPECTORS TEST**

- A. **Inspector Test Orifice:** A trip test connection not less than 1 in (25 mm) in diameter, terminating in a smooth bore corrosion-resistant Stepped orifice, to provide a flow equivalent to one sprinkler of the type installed on the particular system, shall be installed. Viking 5.6K stepped orifice shall be used for inspectors test on systems using the Viking 5.6K stepped orifice sprinkler heads. Inspectors test orifice shall be a Viking 5.6K stepped orifice opened sprinkler (no fusible element) of same make, model and SIN number as installed on system. (No Substitution Allowed).

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. The installation must meet all established standards and be done according to all applicable laws, regulations and codes.
- B. The proper operation and coordination for the system's installation, including the automatic sprinkler system, detection system, signaling system and initial start-ups are all under the responsibility of the fire protection contractor.

### **3.2 TRAINING**

- A. The contractor must plan and organize a training session of at least two hours for the building maintenance staff, in the presence of building owner or his representative.
- B. The training session must include the normal operation, emergency procedures and maintenance of the system.

### **3.3 TESTS AND VERIFICATIONS**

- A. Hydrostatic tests must be performed on the entire sprinkler piping system, as required by NFPA 13.

- B. In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bars) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1½ psi (0.1 bar) during the 24 hours of the test shall be corrected.
- C. A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to make sure that no back pressure in drain piping exists, which could affect the proper operation of the preaction system.
- D. An air supply test must be performed, to confirm that normal air pressure can be restored within 30 minutes.
- E. The verification of the fire alarm system must be done in accordance with the NFPA 72, Chapter 7.
- F. A trip test shall be performed through a stepped orifice on the inspectors test assemble to confirm that the water is delivered through the inspectors test within 60 seconds.

#### **3.4 REPORT & CERTIFICATE**

- A. An inspection report and a certificate must be supplied to the engineer at the completion of the project. All tests results shall be duly registered in a booklet to be included with the inspection report.

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**SECTION 21 13 13**  
**WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all portions of Building 4, including the , mechanical equipment rooms, telephone rooms, elevator machine rooms, and elevator pits.

**1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 33 10 00, WATER UTILITIES.
- C. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
- D. Section 09 91 00, PAINTING.
- E. Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS, .
- F. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.
- G. Section 21 05 11 COMMON WORK RESULTS FOR FIRE SUPPRESSION

**1.3 QUALITY ASSURANCE**

- A. Installer Reliability: The installer shall possess a valid State of California fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, HYDRAULIC CALCULATIONS, SEISMIC BRACE CALCULATIONS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped

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by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:

1. Qualifications:

- a. Provide a copy of the installing Contractors State of California c-16 Fire Protection Contractors license.
- b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.

2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.

3. Manufacturers Data Sheets:

- a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
- b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.

4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.

5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Submittals shall include, but not be limited to, the following:



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- a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
  - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
  - c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
  - d. Certificates shall document all parts of the installation.
  - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.
- 1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
  - 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
    - a. Light Hazard Occupancies: Offices, treatment, and customary access areas.

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- b. Ordinary Hazard Group 1 Occupancies: Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms, .
  - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, , laundry, kitchens, kitchen storage areas, storage areas, building management storage,
  - d. Request clarification from the Government for any hazard classification not identified.
3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
4. Water Supply: Base water supply on a flow test of:
- a. Location Prescriptive Curve from Fresno Fire Department
  - b. Elevation Static Test Gauge \_\_\_\_\_ m  
( \_\_\_\_\_ ft)
  - c. Elevation Residual Test Gauge \_\_\_\_\_ m  
( \_\_\_\_\_ ft)
  - d. Static pressure: \_\_\_\_\_ kPa ( \_\_\_\_\_ 45 \_\_\_\_\_ psi)
  - e. Residual pressure: \_\_\_\_\_ kPa ( \_\_\_\_\_ 35 \_\_\_\_\_ psi)
  - f. Flow: \_\_\_\_\_ L/s ( \_\_\_\_\_ 1800 \_\_\_\_\_ gpm)
  - g. Date: N/A \_\_\_\_\_ Time \_\_\_\_\_ N/A \_\_\_\_\_
5. Provide seismic protection in accordance with NFPA 13.

**1.4 APPLICABLE PUIBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
  - 13-2010.....Installation of Sprinkler Systems
  - 101-22003.....Safety to Life from Fire in Buildings and Structures (Life Safety Code)
  - 170-1999.....Fire Safety Symbols
- C. Underwriters Laboratories, Inc.(UL):
  - Fire Protection Equipment Directory - 2011
- D. Factory Mutual Engineering Corporation (FM):

Approval Guide - [http://www.approvalguide.com/CC\\_host/pages/public/custom/FM/login.cfm](http://www.approvalguide.com/CC_host/pages/public/custom/FM/login.cfm) .

E. IBC - 2010

F. Foundation for Cross-Connection Control and Hydraulic Research-2005

## **PART 2 PRODUCTS**

### **2.1 PIPING & FITTINGS**

A. Sprinkler systems in accordance with NFPA 13.

### **2.2 VALVES**

A. Valves in accordance with NFPA 13.

B. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.

C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).

### **2.3 FIRE DEPARTMENT SIAMESE CONNECTION**

A. Brass, free standing, exterior fire department connection, without sill cock, and a minimum of two 65 mm (2-1/2 inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler".

### **2.4 SPRINKLERS**

A. All sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.

1. Elevator shafts and elevator machine rooms: Standard response sprinklers.

2. Elevator pit: sidewall sprinklers.

3. In electrical rooms: Standard response sprinklers.

(Note: Provide 'cages' to protect sprinkler heads from breakage/damage when the elevation of the head is less than 7 feet 6 inches above finished floor (mechanical rooms, janitor closets, etc)).

- B. Temperature Ratings: In accordance with NFPA 13, except as follows:
1. Sprinklers in elevator shafts, elevator pits, and elevator machine rooms: Intermediate temperature rated.
  2. Sprinklers in Generator Rooms: High temperature rated.

#### **2.5 SPRINKLER CABINET**

Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

#### **2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS**

Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

#### **2.7 SWITCHES:**

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

#### **2.8 GAUGES**

Provide gauges as required by NFPA 13.

#### **2.9 PIPE HANGERS AND SUPPORTS**

Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

## **2.10 WALL, FLOOR AND CEILING PLATES**

Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.
- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.

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- H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- I. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- J. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.
- K. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- M. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- N. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.
- O. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve in occupied spaces. Request in writing at least one week prior to the planned interruption.

### **3.2 INSPECTION AND TEST**

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA

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13, in the presence of the Contracting Officers Technical Representative (COTR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.

- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COTR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

### **3.3 INSTRUCTIONS**

Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.

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